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Discussion of the Selection Coverage and Frequency Alternatives in Inspection and Maintenance Programs

(U.S.) Environmental Protection Agency
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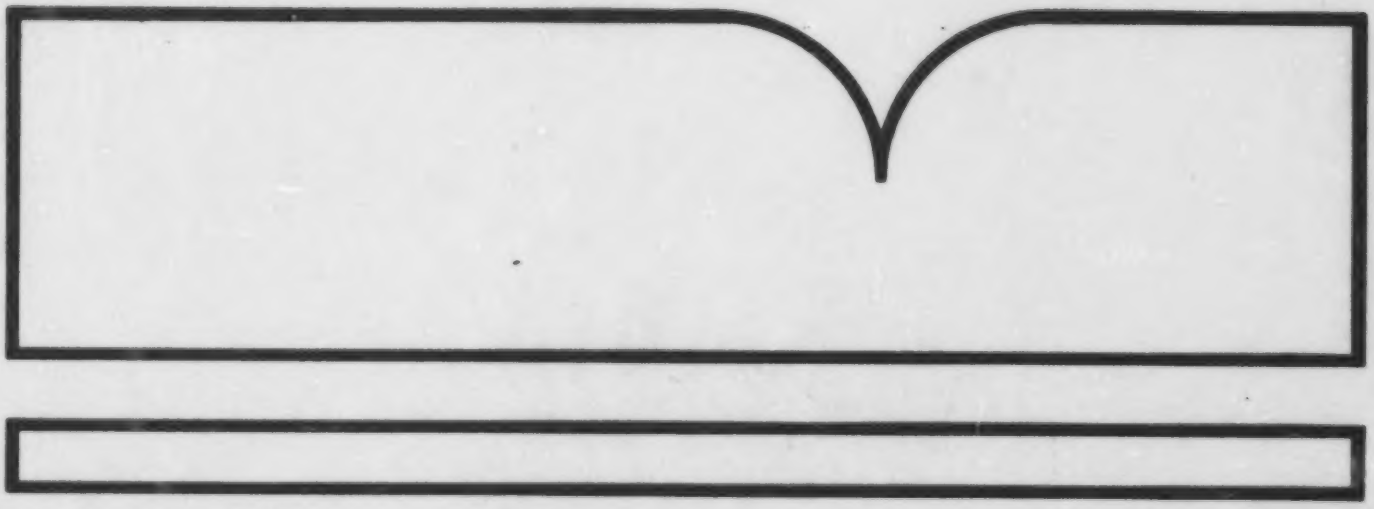

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Technical Report

DISCUSSION OF THE SELECTION OF COVERAGE AND FREQUENCY ALTERNATIVES IN INSPECTION AND MAINTENANCE PROGRAMS

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August 1981

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16. ABSTRACT

Automobile Inspection/Maintenance (I/M) program managers are faced with many decisions when designing and implementing an emissions inspection program on how to best serve the needs of their local area. All of these decisions are impacted by both technical and socio-economic considerations. This report will examine those decisions which concern the coverage of the program and the frequency of inspection.

Specifically, this report addresses the concerns surrounding the selection of the geographic area, vehicle classes, and model years included in the program. Additionally this report discusses the impact of including change-of-ownership inspection and/or random roadside checks along with the annual cycle.

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Discussion of the Selection of Coverage and Frequency Alternatives in Inspection and Maintenance Programs

1.0 INTRODUCTION

Automobile Inspection/Maintenance (I/M) program managers are faced with many decisions when designing and implementing an emissions inspection program on how to best serve the needs of their local area. All of these decisions are impacted by both technical and socio-economic considerations. This report will examine those decisions which concern the coverage of the program and the frequency of inspection.

Specifically, this report addresses the concerns surrounding the selection of the geographic area, vehicle classes, and model years included in the program. Additionally this report discusses the impact of including change-of-ownership inspection and/or random roadside checks along with the annual cycle.

2.0 BACKGROUND

In 1977, the majority of urban areas in the United States exceeded the health-related ambient air quality standards for carbon monoxide (CO) and ozone (O_3). In urban areas, motor vehicles typically contribute ninety percent of the (CO) and fifty percent of the hydrocarbons (HC); the latter combine with other pollutants to form ozone.

The Federal Motor Vehicle Control Program (FMVCP) has operated since 1968 to assure that cars are designed and built for lower emissions. Increasingly stringent emission standards for new cars have resulted in vehicles which are capable of emitting less than ten percent of the emissions of an uncontrolled, mid-1960's model. But the ability of the new car strategies (prototype certification, assembly line testing, and recall of defective designs) to reduce emissions depends on proper use and maintenance by vehicle owners once the new cars are put on the road.

Tests of thousands of typical vehicles, borrowed from their owners, show that much of this emission reduction potential is being lost. Nearly half of the one year old cars on the road exceed federal emission standards, and this increases with the car's age. Most of the cars fail to meet standards because of improper maintenance and adjustments by owners and mechanics after the cars leave the factory. Automobile inspection/maintenance (I/M) programs attempt to solve this problem by providing the incentive for proper maintenance.

The main objective in designing an I/M program is to select program parameters which maximize emission reductions. However, program coverage and frequency alternatives must also be selected based on other considerations, such as cost-effectiveness, consumer protection, program equity, and ease of administration or enforcement. The following sections provide a discussion of these issues in relation to each coverage and frequency option.

3.0 GEOGRAPHIC COVERAGE

The first decisions to be made in selecting the geographic area in which I/M will be implemented are whether the program should focus only upon major urban areas, and then, if so, how far beyond the urbanized area boundary the inspection requirement should extend. For the densely populated States in the Northeast, a logical choice is to make the I/M program statewide. This option has been selected by Massachusetts, Connecticut, Rhode Island, and New Jersey. Other states are at the opposite end of the spectrum with major urban centers isolated within hundreds of miles of sparsely populated desert or mountainous terrain. Here the choice to implement I/M only in the urbanized area is equally logical. For most states, however, the choice is not so simple and must include a consideration of pollutant transport, commuter VMT and ease of administration.

Many of the vehicles which contribute to an urban nonattainment problem (whether CO or ozone) are not garaged in the urbanized area proper. Vehicles from suburban developments in nearby counties may have a large percentage of their VMT occurring during trips for work or recreation to the urban center. A serious problem of public perception arises when urban residents note that not only are they the ones who must live with excessive pollution, but also they must comply with vehicle inspection requirements while their suburban neighbors need not. Thus the coverage area should be large enough to encompass all areas which significantly contribute to the non-attainment problem.

Enforcement considerations assume the most important role in selection of the exact coverage area. Two types of enforcement systems are possible, each with unique implications for the decision. They are sticker systems and registration systems.

Registration systems generally are easiest to enforce, since they require no extra effort on the part of the police. A certificate is issued to vehicles which have complied with I/M program requirements, and this certificate is then used to obtain vehicle registration. Selection of county boundaries as inspection program limits provides a simple mechanism for tying program enforcement to a vehicle registration system. However, if this leads to the inclusion of sparsely populated, rural areas, it is relatively easy to identify subject vehicles by zip codes, city names, or even street names, provided the registration system is computerized. However, as the coverage area is decreased the problems associated with public perception increase. State and county boundaries have been long established. If different boundaries are set for the I/M program, such as non-attainment area boundaries, program managers may have to answer complaints from vehicle owners who reside just within the program limits about the alleged inequity of the I/M requirement.

In sticker enforcement systems, police officers issue citations to vehicles which should have compliance stickers but do not. The main difficulty inherent in a sticker system lies in distinguishing between a non-complying subject vehicle and a non-subject vehicle which is operating in the same area

as subject vehicles. As with the registration system, utilizing the county boundaries surrounding the urbanized area as program limits can provide the simplest mechanism, if license plates contain a symbol or word which identifies the county of registration.

In any case, exemption stickers will be necessary to distinguish vehicles which are not subject to program requirements by virtue of their age, type, or powerplant (diesels are frequently exempt). Issuance of exemption stickers can most easily be accomplished by utilizing the vehicle registration system. If this is done, then the same ability to define the geographic coverage of the program exists as in the case where the registration system is used for enforcement. However, it must be recognized that a sticker system is enforced at least partially at the discretion of patrolling law enforcement officers. The perception that the program requirements are arbitrarily imposed on only part of the population within a political subdivision may impact negatively on rigorous apprehension and prosecution of non-complying vehicles.

3.1 Recommendations

EPA recommends that an I/M program focus on metropolitan areas and include the entire urbanized area and adjacent fringe areas of development. Statewide programs are recommended where states are small and highly urbanized.

4.0 SELECTION OF VEHICLE CLASSES COVERED

4.1 Background

There are several classes of vehicles which could be included in an I/M program. EPA's official definitions (40 CFR 86.079-2) and non-technical descriptions of the various classes are given below:

Gasoline Light-Duty Vehicle (GLDV) - A gasoline-powered passenger car or passenger car derivative capable of seating 12 passengers or less.

Diesel Light-Duty Vehicle (Diesel LDV) - A diesel-powered passenger car or derivative capable of seating 12 passengers or less. This is presently a small class of vehicles, but it is rapidly increasing. U.S. made diesel LDV's increased from 0.37% of U.S. production in 1978 to 2.18% in 1979.

Light Duty Gasoline Truck (GLDT) - Any gasoline-powered motor vehicle rated at 8500 pounds gross vehicle weight (GVW) or less which has a vehicle curb weight of 6000 pounds or less, and which has a basic vehicle frontal area of 45 square feet or less, which is:

(1) designed primarily for purposes of transportation of property or is a derivation of such a vehicle, or

(2) designed primarily for transportation of persons and has a capacity of more than 12 persons, or

(3) available with special features enabling off-street or off-highway operation and use.

This vehicle class includes nearly all pick-ups and vans (except box-type vans). Most are non-commercial vehicles. It should also be mentioned that the limits of 6000 pounds curb weight and 45 square feet frontal area are only used to refine the basic definition of 8500 pounds GVW. There are few vehicles below 8500 GVWR which do not meet the other criteria.

Although current, this definition of LDT's has only been in effect since 1979. From the beginning of federal motor vehicle emissions standards (in 1968) through 1974, LDT's were lumped together with LDV's in one large class of vehicles under 6000 pounds GVW. From 1975 to 1979 LDT's were defined as "any motor vehicles rated at 6000 pounds GVW or less," with the same uses as are currently defined. Then, in 1979, some trucks previously classed as heavy-duty became part of the light-duty class. These are called LDT2's by EPA to distinguish them from vehicles in the original class (LDT1's).

Light-Duty Diesel Trucks (Diesel LDT) - diesel-powered vehicles with the same characteristics as gasoline LDT's. This is a very small class of vehicles, currently less than 1% of the total LDT fleet.

Heavy-Duty Gasoline Trucks (HDG) - any gasoline-powered motor vehicle rated at more than 8500 pounds GVW or that has a vehicle curb weight of more than 6000 pounds or that has a basic frontal area in excess of 45 square feet. These vehicles include large commercial trucks, recreational vehicles and schooltype buses. Prior to 1979, this class included vehicles rated at more than 6000 GVW (see LDT definition for further explanation).

Heavy-Duty Diesel Trucks (HDD) - diesel-powered vehicles with the same weight and frontal area limitations as HDG's. This class of vehicles consists primarily of heavy tractor rigs; transit buses are also in this class.

Motorcycle (MC) - Any motor vehicle with a headlight, taillight, and stoplight and having: two wheels or three wheels and a curb mass less than or equal to 680 kilograms (1499 pounds). (40 CFR 86.402-78)

The relative contributions of the various vehicle classes to total mobile source emissions based on national averages are detailed in Figures 4-1 to 4-4. Percentages are projected by MOBILE2 (EPA's mobile source emission factor computer model) and assume no I/M implementation. Note that for the light-duty classes, diesel and gasoline emissions are combined. The vast majority of vehicles in these classes are gasoline-powered, however.

4.2 Discussion

The vehicle classes inspected in existing I/M programs are shown in Table 4-1. In deciding which vehicle classes to include in an I/M program, a planner should focus on program effectiveness, ease of implementation and equity. Each vehicle class will be discussed separately below, but there are two general considerations which should be mentioned first.

Percent of Total Mobile Source Emissions of HC by Vehicle Classification in 1982

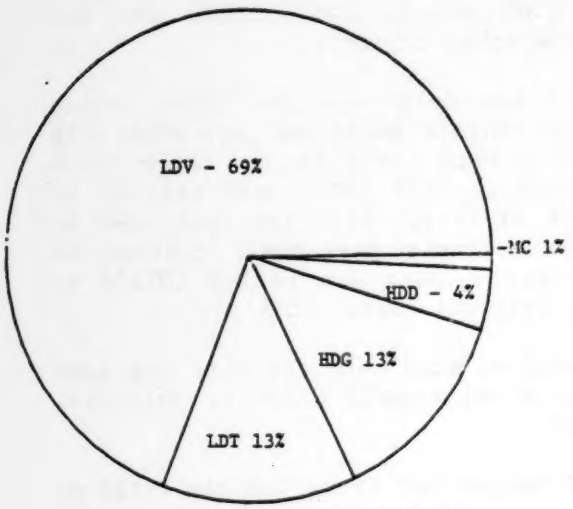

Figure 4-1

Percent of Total Mobile Source Emissions of CO by Vehicle Classification in 1982

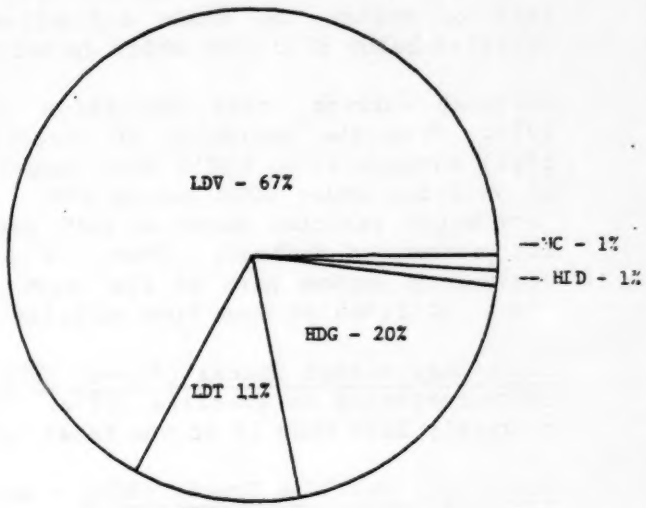

Figure 4-2

Percent of Total Mobile Source Emissions of HC by Vehicle Classification in 1987 (no I/M assumed)

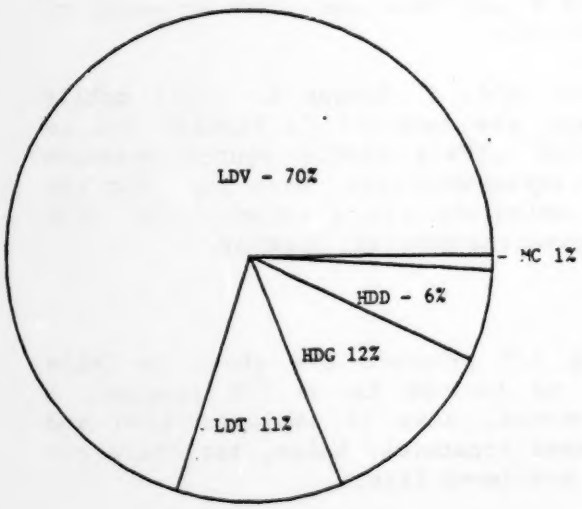

Figure 4-3

Percent of Total Mobile Source Emissions of CO by Vehicle Classification in 1987 (no I/M assumed)

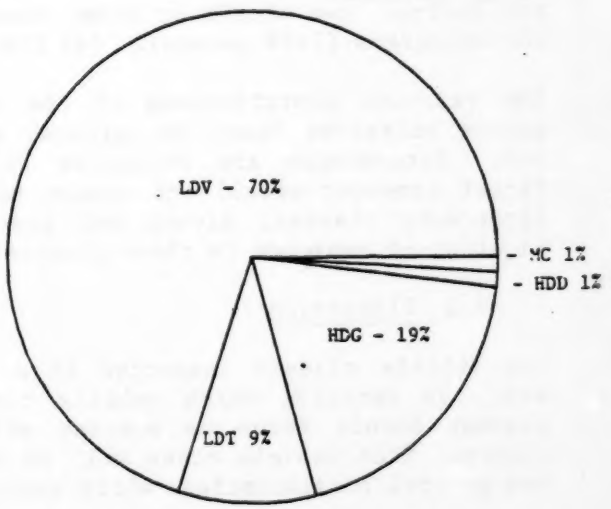

Figure 4-4

Table 4-1

Vehicle Classes Inspected in I/M Programs

	New Jersey	Oregon	Arizona	California	Nevada	Rhode Island	New York	Georgia
GLDV	yes	yes	yes	yes	yes	yes	yes	yes
Diesel LDV	no	yes	yes	no	no	no	no	no
GLDT	6000 lbs.	8500 lbs.	6000 lbs.	8500 lbs.	6000 lbs.	8500 lbs	8500 lbs	6000 lbs
Diesel LDT	no	8500 lbs.	6000 lbs.	no	no	no	no	no
HDG	no	yes	yes	no	no	no	no	no
HDD	yes	no	yes	no	no	no	no	no
MC	no	no	yes	no	no	no	no	no

First, each class of vehicle has its own history of federal standards, so that within each class, vehicles respond relatively uniformly to I/M test procedures and cutpoints, but each class responds differently. Therefore, locally defined categories that cut across EPA classes will result in differential response within the locally defined class, where a portion of the class might have a much higher failure rate than the rest of the class. Thus planners should use EPA definitions if possible. Another option that would not pose problems is to define vehicle categories which are subsets of the EPA classes. Thus defining LDT's as all trucks below 6000 pounds GVW would not cut across EPA classes, but a limit of 10,000 pounds would.

Second, it should be pointed out that the most important criteria for selecting vehicle classes to include in an I/M program is that a significant emission reduction can be obtained from that class through I/M. It will be seen that some vehicle classes, particularly the diesel ones, are not capable of meaningful emissions reductions through I/M. A class-by-class discussion of the vehicle coverage question is given below.

Gasoline LDV's and LDT's - These vehicles are known to have a large potential for emissions reduction through I/M. Benefits have been demonstrated in EPA's Portland Study. Furthermore, the short test procedures available are both practical and effective in identifying high emitters in these classes. Emissions reductions projected by MOBILE2 from LDV's and LDT's are approximately the same on a per-vehicle basis.

Diesel LDV's and LDT's - There is no known potential for HC and CO emissions reductions from these vehicles through I/M. Preliminary indications are that diesels do not deteriorate rapidly in their emissions of these two pollutants, as gasoline vehicles do. Therefore they are not good candidates for an I/M program at this time.

There is no doubt, however, that the issues of equity and public perception are of concern here, particularly as the number of diesel powered passenger cars grows. The I/M program manager has a number of options: 1) diesels may be specifically exempted, and an effort made to improve the public's understanding of the technical reasoning; 2) diesels may be treated as other LDV's, with recognition that failures will be rare and problems may arise from the effect of diesel exhaust on the infrared analyzer, and 3) diesels may be required to pass an opacity test rather than comply with emission cutpoints.

HDG's - There is a strongly suspected but unquantified potential for reduction of HDG HC and CO emissions through I/M. HDG engines were first regulated for HC and CO emissions in 1970; NOx emission standards followed in 1974. The technology to control emissions used on these vehicles is typically engine modification, such as timing changes and leaner carburetor settings. EPA expects that improper engine adjustments will be as prevalent on HDG vehicles as on LDVs, and that proper maintenance will produce substantial emission reductions as it has been shown to do on 1972-74 LDV's which used similar emission control techniques. It is also expected that the same I/M short tests, including the idle test, will be able to identify high emitting HDG vehicles.

HDD's - As with light-duty diesels, heavy-duty diesel trucks have no known potential for HC or CO emissions reductions through I/M. Again, data suggest that these vehicles do not deteriorate significantly over time in their exhaust emissions. Approximately 60 percent of HDD VMT is short-haul, and is accrued mostly in urban areas. Smoke reduction potential does exist, but the number of excessively smoking diesels has not been quantified by EPA. Smoke testing requires a loaded test using a dynamometer if it is to be meaningful, since the smoke level at idle is not a good indication of smoke levels under load. Arizona's mandatory smoke check for diesels is at idle, and very few fail.

There are also many political and administrative problems involved in testing heavy-duty diesels. Most HDD's are interstate vehicles, thus they would be exempt from testing in all but their home states. Even in-state trucks may be from an area where I/M is not required.

Motorcycles - Motorcycles have good HC and CO emissions reduction potential per vehicle through I/M, but a combination of small numbers and their relatively low vehicle mileage makes the total reduction achievable very small. As shown in Figures 4-1 to 4-4, motorcycles account for a negligible fraction (less than 1%) of total mobile source emissions.

4.3 Recommendations

For the present, EPA recommends testing gasoline light-duty vehicles and gasoline light-duty trucks. The efficacy of testing these vehicle classes has been proven, and it is relatively simple to test gasoline LDT's in addition to LDV's. Furthermore, there is a large emission reduction benefit to be obtained from testing these vehicles, as seen in Figures 4-1 to 4-4. Since most LDT's are used for personal transportation, a serious equity argument arises if this class is excluded. It is recommended that a definition of less than 8500 pounds GVW be placed on LDT's if EPA's exact definition cannot be met using existing registration procedures.

When more data are available on the emissions reduction potential of heavy-duty gas trucks, and states and local areas have overcome the start-up problems in inspecting LDV's and LDT's, they can evaluate the need for testing these vehicles, and add them if desired. In a centralized program it might be wise to design some of the inspection lanes to be wide and tall enough to accommodate these trucks.

5.0 SELECTION OF MODEL YEARS COVERED (AGE EXEMPTIONS)

An I/M program may exempt older model year vehicles from program requirements. Such exemptions may be considered to be desirable for many reasons, some of which are discussed below. However, exemptions reduce the effectiveness of an I/M program, so they involve a tradeoff.

Olders cars have less sophisticated emissions controls than are currently available. Pre-1968 vehicles were not subject to Federal emission standards, although most domestic models have been equipped with PCV valves since 1963.

Nevertheless, older vehicles have a substantial per-vehicle potential for emissions reductions, since they are often malmaintained. However, even though they have a substantial per-vehicle emissions reduction potential, they represent a smaller and smaller fraction of the total vehicle miles traveled (VMT). This is because older cars are a declining segment of total registration, and they tend to be driven less as they get older.

Exemptions for older cars might be advantageous for several reasons. First of all, there is a tendency for older vehicles to be driven by lower income groups and to have higher average repair costs. Age exemptions could protect the owners of older cars from repair costs that are beyond their means, or large in proportion to the worth of their cars. Secondly, antique cars would be exempted by such a system. The wide variety and small numbers of antique cars make testing impractical. Their total VMT is also negligible. Finally, exemptions might be in order simply because older cars represent a declining portion of total VMT.

There are two types of age-based exemption systems. A fixed model year exemption system exempts all cars older than a certain model year. For example, all cars older than 1968 model year cars might be exempted. The other type of age-based exemption is the moving model year exemption system wherein a specified number of the most recent model years are inspected at a given point in time and older model years are exempted. If "AGE" is defined as "CALENDAR YEAR" minus "MODEL YEAR", then cars with AGE greater than the specified number of model years are not inspected in that calendar year. For example, in 1983 a fifteen model year moving exemption would exempt model year 1967 and older cars. However, in 1988 a fifteen model year moving exemption would exempt model year 1972 and older cars. The moving model year exemption is slightly more complicated than the fixed model year exemption but is more equitable since all vehicles will eventually be eligible for the exemption, not just cars older than a certain arbitrary model year.

The effects of both fixed and moving age exemptions on I/M program emission reductions are illustrated by Figures 5-1 and 5-2. The adjustment factors presented in the figures relate to the percent of full I/M benefits (i.e. a program which includes the most recent 19 model years) that would be achieved under various age exemption scenarios. Fixed model year exemptions can be modeled through normal MOBILE2 input. Moving model year exemptions are modeled via adjustment factors given in Table 5-1.

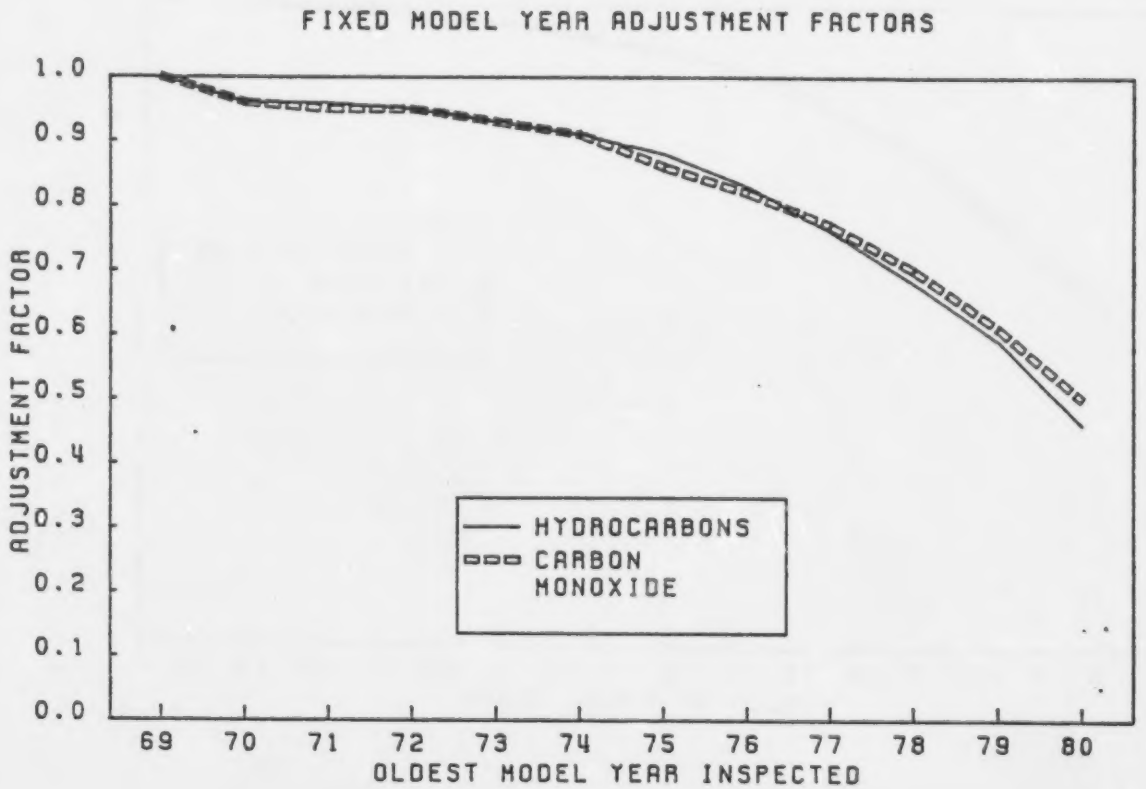
FIXED MODEL YEAR ADJUSTMENT FACTORS
ADJUSTMENT FACTOR
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
HYDROCARBONS
CARBON MONOXIDE
69
70
71
72
73
74
75
76
77
78
79
80
OLDEST MODEL YEAR INSPECTED

Figure 5-1

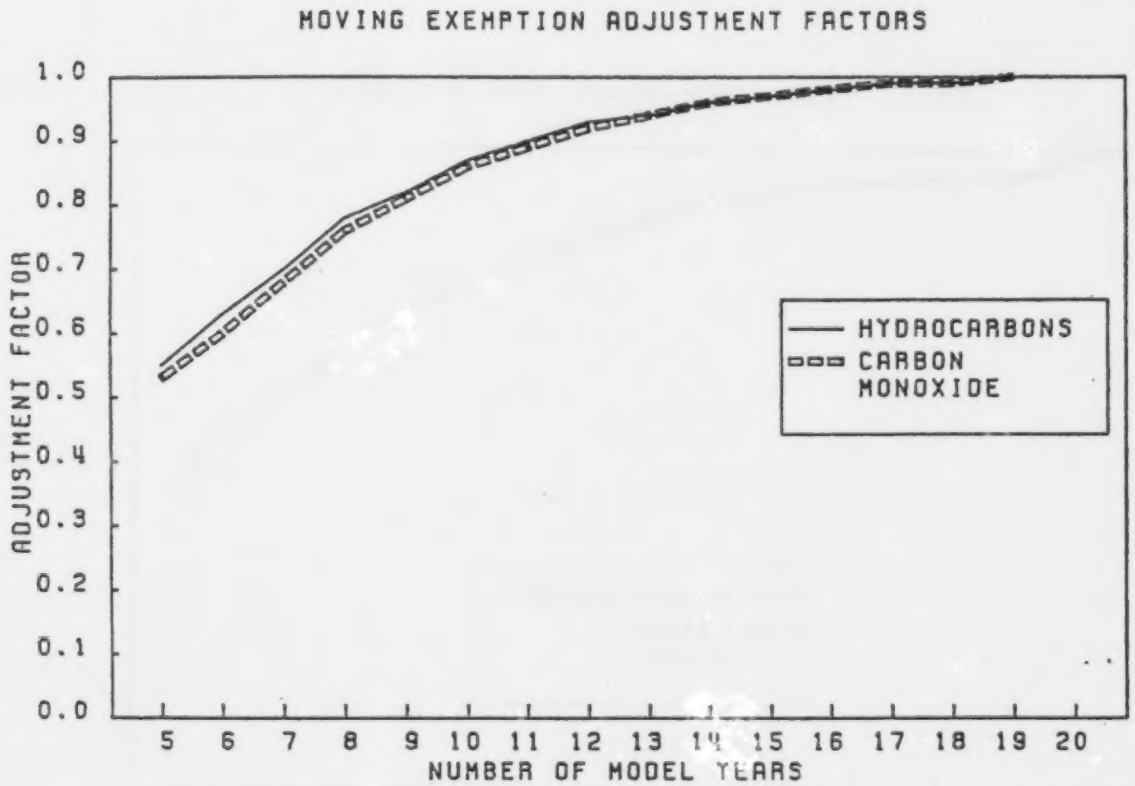
MOVING EXEMPTION ADJUSTMENT FACTORS
ADJUSTMENT FACTOR
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
NUMBER OF MODEL YEARS
HYDROCARBONS
CARBON MONOXIDE

Figure 5-2

Table 5-1

Moving Model Year Exemption Adjustment Factors for January 1, 1988 Evaluation of an I/M Program

Number of Model Years *	Adjustment Factors **	
	HC	CO
19	1.00	1.00
18	.99	.99
17	.99	.99
16	.98	.98
15	.97	.97
14	.96	.96
13	.94	.94
12	.93	.92
11	.90	.89
10	.87	.86
9	.82	.81
8	.78	.76
7	.70	.68
6	.63	.60
5	.55	.53

* If AGE=CALENDAR YEAR - MODEL YEAR, cars with AGE greater than "Number of Model Years" are not inspected.

** Adjustment factors are relative to an I/M program that inspects all model year vehicles, which in MOBILE1 or MOBILE2 is the same as the most recent 19 model years. Care should be taken when running MOBILE1 or MOBILE2 to input the model year coverage so that at least 19 model years, ending with the model year that is the same as the evaluation year, are covered.

5.1 Recommendations

EPA makes no recommendations as to whether to grant age exemptions. But, if a state desires them, for whatever reasons, EPA recommends:

(1) exemption of pre-1968 vehicles altogether, and
(2) exemption of cars with AGE greater than 15 years.

Exemption of these vehicles, while accomplishing many of the goals of age waivers, preserves most of the program's effectiveness. (For all practical purposes, in calculating effectiveness, this program is the same as one with only a 15 model year moving exemption; Table 5-1 can be used to calculate effectiveness). The following table illustrates which model years would be included in the recommended program for the calendar years 1980 through 1987.

Calendar Year	Model Years Included
1980	1968 and later
1981	1968 and later
1982	1968 and later
1983	1968 and later
1984	1969 and later
1985	1970 and later
1986	1971 and later
1987	1972 and later

6.0 SELECTION OF INSPECTION FREQUENCY

6.1 Background

A program of required vehicle inspections could conceivably be implemented by several different schedules. The primary schedule types are:

Annual inspection - inspection of each subject vehicle on an annual basis.

Change-of-ownership inspection - inspection of each subject vehicle upon change-of-ownership.

Random Roadside Checks - random inspection of subject vehicles on the road.

One, or a combination of these inspection schedules could be utilized. However, a program which relies only on change-of-ownership inspection or random roadside checks will not provide significant emission reductions, and cannot substitute for annual inspection. A typical combination might be annual inspection combined with change-of-ownership inspection. Another factor to be considered is the distribution, or spacing, of the inspections thoughout the year.

6.2 Discussion

Annual Inspection

Annual inspection is the heart of the I/M program. Change-of-ownership and roadside inspections can increase program effectiveness slightly, but the majority of benefits will be derived from the regular annual inspection of vehicles.

Benefits for annual inspections are calculated using EPA's computer program for emission factor prediction, MOBILE2. An important assumption of the model is that inspections are staggered through the year, thus distributing benefits evenly. Staggered programs also permit the most efficient use of inspection facilities and personnel.

Change-of-Ownership

Change-of-ownership inspection is the term used to represent a program where inspection is required upon transfer of title of a used motor vehicle and also when a used motor vehicle is registered for the first time in a specific political jurisdiction. In the absence of an annual inspection requirement a change-of-ownership I/M program will provide only a fraction of the emission reductions benefit that an annual program will provide. This fraction will be equal to the percent of the local fleet which changes ownership each year (typically 20%).

Most I/M program managers will be concerned with the impact of adding a change-of-ownership inspection to the annual cycle. The following discussion concerns the emission reduction impact associated with a combined program.

The I/M benefits which are calculated by EPA's computer model MOBILE2 are based on the assumption that each vehicle is inspected on the anniversary of its initial sale to its first owner. This would be true if registrations were good for one year and vehicles never changed ownership, for example. In reality, vehicles change ownership and this may make annual inspection only on the anniversary of initial sale undesirable or impractical. To illustrate, consider a vehicle which has been inspected annually each April because it was first bought from a new car dealer in April 1979. If this vehicle changes ownership in September 1985, there are four possible schedules it may be required to follow as a result:

(i) No inspection in September 1985; inspection in each April thereafter.

(ii) Inspection in September 1985 as a precondition to the change in ownership; inspection in April 1986 and each April thereafter.

(iii) Inspection in September 1985; and each September thereafter.

(iv) No inspection in September 1985; inspection in each September thereafter.

Which of these schedules will apply depends on the individual state's systems of vehicle registration and I/M enforcement. A state may already find itself locked into just one of the schedules under existing statute, with no latitude to choose another schedule via agency regulations. Or a state may be able to choose from among two or more of the schedules when the responsible agency promulgates regulations.

Schedule (i) is exactly the schedule assumed in the MOBILE2 model, so no adjustments to MOBILE2 benefits are needed. This schedule would be observed in a state where the registration cycle is tied to the vehicle (either by relating to the date of initial purchase or to a vehicle identifier such as the VIN) and there is no change-of-ownership inspection.

Schedule (ii) results in some vehicles having two successive between inspection intervals which are shorter than one year (in the example case, the interval from April 1985 to Septembr 1985 and the interval from September 1985 to April 1986). Because of the additional inspection and repairs the benefits of Schedule (ii) are slightly higher than for Schedule (i), and therefore, slightly higher than calculated by MOBILE2. Table 6-1 shows EPA's estimates of the incremental credits from Schedule (ii). The incremental credits, which range from 1% to 4% depending on what fraction of the local fleet changes ownership each year, are added to the benefit modeled for the annual program.

Schedule (iii) results in some vehicles having a single between-inspection interval which is shorter than one year, rather than the two short intervals in Schedule (ii) (in the example case, the interval from April 1985 to September 1985). There are incremental benefits of this schedule over Schedule (i), but they are smaller than the incremental benefits of Schedule (ii). Specifically, one-half of the incremental credits shown in Table 6-1 may be used for Schedule (iii).

Schedule (iv) results in some vehicles having a between-inspection interval which is longer than one year, possibly as long as two years (in the example case, the interval from April 1985 to September 1986). Incremental credits equal but opposite in sign to those shown in Table 6-1 must be applied to reflect the loss in benefit caused by these longer intervals.

Table 6-1

Incremental Credits for Schedule (ii) Type Change-of-Ownership I/M
(evaluated on January 1, 1988)

Local Rate of	20% Stringency		30% Stringency		40% Stringency	
Change of Ownership(*)	HC	CO	HC	CO	HC	CO
15	1	1	1	2	1	2
20	1	2	1	2	2	4
25	1	2	2	4	2	4

(*) Percent of total fleet which changes ownership each year.

Adding a change-of-ownership inspection to the annual cycle increases the demand for inspection facilities (test lanes, instrumentation, personnel, etc.) in proportion to the percent of the fleet which turns over each year. However the emission reductions do not increase by a comparable percentage. Thus the decision to add a change-of-ownership inspection may be most influenced by the desire to protect buyers of used vehicles from unknowingly accepting a vehicle which will have a large repair bill at its next inspection. This protection occurs only if purchasers are aware of the requirement before they buy when there is still time to negotiate with the seller, and not after the sale when they attempt to re-register the vehicle. A strong public awareness campaign, and access to the inspection stations by prospective sellers and buyers for voluntary inspections might be equally effective at warning car buyers of this peril and giving them a way to protect themselves.

Random Roadside Checks

Due to limited resources, random roadside checks are not usually extensive enough to yield any significant emission reduction from the vehicles that are failed by the checks and forced to get repairs. The emission benefit resulting from a roadside check program, if any, presumably comes from its deterrent effect. Because they fear being failed in a roadside check, owners might take better care of their vehicles and refrain from misadjusting them between regular inspections. The magnitude of this tendency depends on the likelihood of being caught and the "penalty" an owner suffers for failing a roadside check. This penalty can range from merely being required to get the failed vehicle repaired and reinspected to having to pay a fine.

It is unlikely that any state would establish a fine so large that enough owners would continue to get precautionary repairs to result in the required reductions from a roadside check program alone. Therefore, a random roadside check program by itself is not a substitute for regular, periodic inspections.

Random roadside checks could be added, however, to an annual I/M program. There are many possible reasons why a vehicle which passed its regular inspection might fail a subsequent roadside check. Natural deterioration in the engine since the last inspection is one possibility. In a decentralized program, the garage may have incorrectly certified the vehicle as passing its last inspection. Or, the owner or a mechanic may have tampered or misadjusted the car since the last inspection. Penalizing owners who fail roadside checks is fair only if the owner is responsible (e.g., if the owner misadjusted the vehicle or asked a mechanic to do so). Since it would be impossible to determine when owners are responsible for the failures, no fine would be completely fair. EPA therefore recommends that roadside check data only be used for program assessment and that no penalties be imposed as a result of roadside check failures.

Random roadside checks can have indirect benefits in addition to the small direct benefits that come from repair of vehicles which fail the checks and from the mild deterrent effect. Roadside checks can be used to monitor program operation and pinpoint problems that need special corrective attention. For example in a decentralized program, roadside checks showing that recently inspected cars have a much higher failure rate than being reported by licensed garages for regular inspections would indicate widespread error by garages in inspecting cars. Or, it might be found that cars recently inspected at specific garages have a much higher roadside failure rate than other cars. Either situation means the state should increase its garage surveillance and quality assurance programs.

Inspection Window

Under any inspection schedule, there is a window in time within which each vehicle must pass inspection. Most states with operating I/M programs define this period as two or three months prior to the compliance deadline, which provides sufficient time for owners to obtain any needed repairs.

6.3 Recommendations

The recommended program consists of annual, staggered inspections. The recommended inspection window is 2 or 3 months prior to registration expiration.